

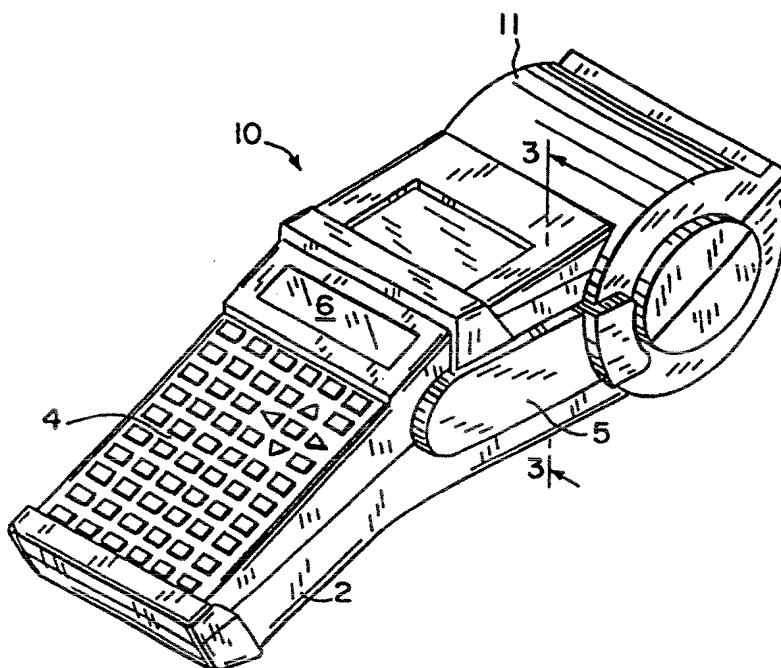


## INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

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(54) Title: THERMAL TRANSFER RIBBON CARTRIDGE



## (57) Abstract

A thermal transfer ink ribbon cartridge (5) for a bidirectional hand held printer (10) forms and integral part of the printer sidewall (49). Take up and supply spools (32, 34) rotatably accommodated in the cartridge housing allow loading of the ink ribbon (13) without directly handling the ribbon. A pair of spring clips (64) within the cartridge housing maintains the ink ribbon (13) in tension.

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## THERMAL TRANSFER RIBBON CARTRIDGE

## TECHNICAL FIELD

The present invention relates to an ink ribbon cassette for use in a thermal transfer printer, and more particularly to an ink ribbon cassette for use in a bidirectional hand held thermal transfer label printer.

## DESCRIPTION OF THE BACKGROUND ART

There are a number of U.S. patents that disclose electronic apparatus for printing indicia on labels, some of these are restricted to hand held units and others that disclose tabletop units. Hand held labeling machines are disclosed, for example, in U.S. Pat. Nos. 4,264,396, Stewart; 4,407,692, Torbeck; 4,473,426, Goodwin et al.; 4,477,305, Hamisch; 4,490,206, Makely; 4,497,683, Hamisch; 4,498,947, Hamisch et al.; 4,511,422, Hamisch et al.; 4,544,434, Mistyurik; 4,556,442, Torbeck; 4,561,048, Hamisch et al.; and 4,680,078, Vanderpool et al. Tabletop units for this general purpose, some of which are portable are described in U.S. Pat. Nos. 4,440,248, Teraoka; 4,501,224, Shibayama; 4,630,538, Cushing; and 4,655,129, Wirth et al.

The electronic machines for printing labels of the type disclosed above all include the same general combination of elements, a print head, means for feeding labeling media to be printed past the print head, a microprocessor, a read only memory programmed with

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appropriate instructions to operate the microprocessor, a random access memory, a keyboard with letter, number, and function keys for the entry of alphanumeric information and instructions concerning the indicia to be printed, and a visual display such as a LED, LCD unit to assist the operator in using the machine. In a hand held printer, these components may all be enclosed in a single housing.

The labeling media comprises a series of labels that are attached to a carrier strip. The carrier strip is fed through the printer and legends are printed on the labels. The labels are then removed from the carrier and attached to the objects needing identification. As there are many types of label applications, there are many combinations of labels and carrier strips that provide labels of varying sizes, colors and formats.

A particular type of print head employs thermal transfer printing technology. Thermal transfer printing uses a heat generating print head to transfer a pigment, such as wax, carbon black, or the like, from a thermal transfer ribbon to a labeling media. By using digital technology, characters are formed by energizing a sequence of pixels on the print head which in turn melt the wax or other pigment on the ribbon transferring the image to the labeling media.

Handling of thermal transfer ribbon for printers that utilize loose spools for supply and take up of the ribbon is extremely difficult and tedious due to the limp and fragile nature of the ribbon itself. Therefore, it is desirable to provide a self contained printer ribbon

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cartridge where handling of individual ribbon spools or the ribbon itself is not required. It is also desirable to provide a ribbon cartridge that cannot be incorrectly inserted into the printer causing damage to the ribbon, printer, cartridge or print media.

Furthermore, most printers of the type described above feed the ink ribbon in the "forward" motion only. Therefore, it is rather straightforward to maintain tension on the ribbon to prevent wrinkling. For example in U.S. Pat. No. 5,597,249, Mistyurik, an ink ribbon cartridge is disclosed having a brake member on a supply spool that is in frictional contact with a core having the ink ribbon thereon. This solution, however will not work in a bidirectional printer that requires the ink ribbon spools to function as either the take up or supply spool depending upon the ink ribbon direction of travel.

#### SUMMARY OF THE INVENTION

The present invention is a novel ink ribbon cartridge used in a bidirectional hand held thermal transfer printer that can maintain tension in the ink ribbon in any direction of ribbon travel. More particularly, the cartridge includes a housing for containing ribbon, take up and supply spools rotatably mounted in the housing and a tension member acting on each spool to provide drag on the spool and create tension in the ribbon during travel in the forward or reverse direction.

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A general objective of the present invention is to provide an ink ribbon cartridge that does not require handling the ink ribbon. The housing substantially encloses the ribbon and slots therein allow the ribbon to pass over the print head during use. The ink ribbon cartridge is self contained and insertable into the printing machine. A user can thus load the cartridge into the printing machine without coming into contact with the ink ribbon.

Another objective of the present invention is to provide an ink ribbon cartridge that maintains tension in the ink ribbon while traveling in the forward or reverse feed direction. A spring clip snapped in place between a pair of flanges on the ribbon spools provides directional drag. The drag caused by the spring clips acting on the spools maintains tension in the ink ribbon regardless of feed direction.

Yet another objective is to minimize the number of parts in the printing machine. The cartridge forms an integral part of the exterior of the printing machine housing sidewall. Doors or panels are thus unnecessary to cover the cavity opening once the ink ribbon cartridge is inserted.

The foregoing and other objects and advantages of the invention will appear from the following description. In the description, reference is made to the accompanying drawings which form a part hereof, and in which there is shown by way of illustration a preferred embodiment of the invention. Such embodiment does not necessarily represent the full scope of the invention, however, and

reference is made therefore to the claims herein for interpreting the scope of the invention.

#### BRIEF DESCRIPTION OF THE DRAWINGS

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Figure 1 is a perspective view of a hand held label printer which employs the present invention;

Figure 2 is an exploded perspective view of the printer in Fig. 1;

10 Figure 3 is a section view of the printer in Fig. 1 showing the ink ribbon and labeling media path;

Figure 4 is a perspective view of the ink ribbon cartridge in Fig. 2;

15 Figure 5 is an exploded view of the ink ribbon cartridge of Fig. 4;

Figure 6 is a perspective view of the print frame assembly of the printer in Fig. 1;

Figure 7 is a perspective view of the cartridge in Fig. 4 with the base top wall detached; and

20 Figure 8 is a section view of the ink cartridge in Fig. 7.

#### DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

25 Referring particularly to Figs. 1 and 2, a thermal transfer printing machine 10 which employs the preferred embodiment of the present invention includes a molded plastic housing 2 that supports a keyboard 4 on its front surface and a display 6 positioned above the keyboard 4.

30 The housing 2 has a cavity 12 formed in the housing 2

above the display 6 for receiving a spool 20 containing labeling media 22. The labeling media 22 is formed as a roll which is carried by the spool 20. The spool 20 is inserted into a receptacle cavity 12 on the printer 10 and the labeling media is threaded past a print head 8, as shown in Fig. 3. A cover 11 enclosing the spool 20 and labeling media 22 in the receptacle cavity 12 is pivotally mounted to the housing 2.

The labeling media 22 is comprised of a carrier web 3 which supports a series of adhesive labels 1. The size, color, and type of label material carried by the spool 20 varies depending upon the particular print application. The labeling media 22 unrolls off the spool 20 as it is consumed by the printer 10.

As shown in Fig. 3, the thermal print head 8 in the printing machine 10 is arranged to cooperate with a thermal transfer ribbon 13 and the labeling media 22 such that the print head 8 can print characters or symbols on the labeling media. This is described in greater detail in U.S. Patent No. 5,078,523 which is incorporated herein by reference.

More specifically, circuitry in the printing machine drives the drive roller 30 and a take up spool 32 to advance the labeling media 22 and ribbon 13. When a desired character is input by an operator or other means, the electronics of the machine 10 energizes pixels on the thermal transfer head 8 as the labeling media 22 and ribbon 13 advance past the head 8. The head pixels are variously energized to imprint the character on the labeling media 22.



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The ink ribbon cartridge 5 shown in Figs. 3 - 5, having a thermal transfer ribbon 13 disposed within the cartridge 5, is inserted into a cavity 15 in the side of the printing machine housing 2. The ribbon cartridge 5 shown in Figs. 4 and 5, rotatably accommodates a supply spool 34 containing the ribbon 13 and the take up spool 32 for taking up the inked ribbon 13 as it is used in the thermal transfer printing process. When the direction of ink ribbon 13 travel is reversed, the ink ribbon 13 is taken up by the supply spool 34 and ribbon 13 is unwound from the take up spool 32.

Referring particularly to Fig. 4-7, the ink cartridge has a base 41 and a pair of substantially cylindrical, parallel casings, 46 and 48, extending therefrom. The cartridge base 41 is shaped to conform with the exterior body shape of the printer housing 2 thereby forming a part of the exterior printer body and rendering doors to cover the inserted printer cartridge 5 unnecessary.

The cartridge base 41 has a bottom wall 44 and a top wall 45. A sidewall 49 along the perimeter of the top wall 45 extends toward the bottom wall 44. Similarly, a sidewall 51 along the perimeter of the bottom wall 44 extends toward the top wall 45. The bottom wall sidewall 51 is slidably inserted inside of the top wall sidewall 49, thus defining the cartridge base interior. The bottom wall 44 and top wall 45 are releasably attached to each other by tabs 52 in the bottom wall sidewall 51 that releasably engage slots 55 in the top wall sidewall 49.

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The casings, 46 and 48, are integrally formed in the base bottom wall 44, and extend away from the base top wall 45. Spools, 32 and 34, are inserted into the casings, 46 and 48, through openings in the bottom wall 44 when the top wall 45 is detached. The two casings 46 and 48 are spaced apart to define a gap 57 therebetween for accommodating the print head 8 when the cartridge 5 is inserted into the printing machine 10. Casing 46 rotatably accommodates take up spool 32 and casing 48 rotatably accommodates supply spool 34.

In the forward feed direction, ribbon 13 unwinds from the supply spool 34 and exits the casing 48 through a slot 63 that extends substantially the length of the casing 48 parallel to the casing longitudinal axis 69. The ribbon 13 bridges the gap 57 defined by the casings, 46 and 48, and enters the casing 46 through a slot 65 that extends substantially the length of the casing 46 parallel to the casing longitudinal axis 75. The ribbon 13 is then wound on to the take up spool 32 rotatably accommodated within the casing 46. By only exposing ribbon 13 in the gap 57 and maintaining the balance of the ribbon within the cartridge 5, direct handling of the ribbon 13 is unnecessary.

As shown best in Fig. 7, the slots 63 and 65 in the respective casings 48 and 46 are parallel to each other and define the boundaries of the gap 57. As shown best in Fig. 3, the slot 63 is positioned such that the ribbon 13 contacts the rounded edge 80 of the slot 63 as it exits the casing 48. Slot 65 is positioned such that

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the ribbon 13 is fed on to the take up spool 32 without engaging the edges of the slot 65.

As shown in Fig. 5, each spool, 32 and 34, has a first flange 54 and second flange 56 which are spaced apart to receive the ink ribbon 13 therebetween. A third flange 58 is also formed on the end of each spool 32 and 34 that extends into the cartridge base 41. As shown best in Figs. 7 and 8, a spring clip 64 snaps in place between the flanges 56 and 58 on each spool 32 and 34 to provide directional drag on the spools 32 and 34. The spring clips 64 are semi circular having a short leg 81 terminating at one end of the clip and a long L-shaped leg 83 at the opposite end of the clip. Both legs 81, 83 extend away from the semi circular center. Tabs 53 integrally formed in the cartridge base lower wall 44 anchor the L-shaped leg 83 of the spring clips 64.

The spring clips 64 restrain spools 32 and 34 from freely rotating within their casings 46 and 48. More importantly, the spring clips 64 minimize ribbon wrinkling by maintaining tension in the ribbon 13 in both the forward and reverse feed direction. The clips 64 maintain tension in the ribbon by creating frictional drag on the spools 32 and 34. In the forward direction, the frictional drag prevents the supply spool 34 from rotating freely when the drive roller 30 ceases to pull ribbon 13 off of the supply spool 34. By preventing free rotation of both spools, 32 and 34, tension in the ribbon 13 is maintained in either feed directions. Thus, tension in the ink ribbon 13 maintained by the spring

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clips 64 minimizes wrinkling of the ribbon 13 in either direction of travel by the ribbon.

5 The shape of the spring clips 64 exerts a directional drag on the spool. Directional drag is drag exerted on a spool that is greater when the spool is rotating in one direction as compared to the opposite direction. Thus, proper clip orientation, as shown in Fig. 5, 7, and 8, provides more drag on a spool when it is supplying ribbon and less when it is taking up ribbon. 10 When a spool is taking up ribbon, the drag is weaker and the ribbon tension is determined by an over-driven ribbon gear/slip clutch system as fully described in copending patent application METHOD AND APPARATUS FOR MAINTAINING RIBBON TENSION, Attorney Docket No. 180003.93678 filed 15 simultaneously with the present patent application and incorporated by reference herein.

Extensions 77, as shown best in Fig. 5, are formed on the end of each spool 32 and 34. The extensions 77 are received in openings 50 formed in the end of each casing 46 and 48. The end of each spool 32 and 34 is 20 thus accessible to the user who can manually pretension the ink ribbon 13 prior to insertion of the cartridge 5 into the printing machine 10.

A leaf spring 60 adds minimal drag to the spools. 25 More importantly spring 60 longitudinally retains the spools, 32 and 34 and ensures the spools are lightly spring loaded against flanges 79 at the base of drive spindles, 42 and 43. The spring loading aids in squaring the spools to the print head 8. The leaf spring 60 has a 30 center opening 62 in which a locating member 69 is

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inserted therethrough. The locating member 69 is an extension integrally formed in the base top wall 45 to properly locate and hold the leaf spring 60 in place. The spring 60 is maintained in compression by the cartridge base top wall 45.

As the cartridge 5 is inserted into the cavity 15 in the side of the printing machine housing 2, it is received by a print frame assembly 40, shown in Fig. 6. Drive spindles, 42 and 43, rotatably mounted in the print frame assembly 40 are received in holes 73 in the spools, 32 and 34. The holes 73 extend along the longitudinal axis, 69 and 75, of the spools, 32 and 34.

The spindles, 42 and 43, rotatably drive the take up and supply spools, 32 and 34. The spindle 42 and 43 diameter changes from a maximum diameter near the spindle base to a minimum diameter at the spindle end. The spindle 42 and 43 rotatably drives the spool 32 and 34 by engaging the inside of the spool 32 and 34 at the maximum diameter of the spindle, 42 and 43.

The spindles, 42 and 43, also cooperatively square the spools to the print head 8. Flanges 79 at the bases of spindles, 42 and 43, press against the spools 32 and 34, further compressing the leaf spring 60, to square the spools to the print head 8. In addition, the smaller diameter portion of the spindles, 42 and 43, are received by shafts 61 integrally formed in the base top wall 45. The shafts 61 extend from the base top wall 45 toward the base bottom wall 44 are received by the spool ends not receiving the drive spindles, 42 and 43. The spools, 32 and 34, rotate about the shafts 61 when taking up or

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supplying ribbon 13. The spindles, 42 and 43, flanges 79 and shafts 61 cooperatively locate the spool ends to square the spools to the print head 8.

5 Proper insertion of the cassette 5 into the printer cavity 15 is ensured by various means and methods. The print cavity 15 and print frame assembly opening 47 correspond to the cartridge shape allowing the insertion of only a properly shaped and oriented cartridge 5. Wing extensions (not shown) on the exterior of the housing are  
10 received by corresponding structure in the print frame assembly 40 and printer housing 2 further ensure proper cartridge orientation.

Finally, a locating pin hole 68 integrally formed in the supply spool casing 48 interacts with a corresponding  
15 locating pin 71 rigidly attached to the print frame assembly 40. The locating pin 71 enters the locating pin hole 68 when the cartridge 5 is properly inserted into the print frame assembly 40 ensuring that the cartridge is properly positioned.

20 In operation, prior to insertion of the ink ribbon cartridge 5 into the printing machine cavity 15, the print head 8 is moved away from the drive roller 30 by activating a lever operated cam assembly 74. The cartridge 5 is then inserted into the printing machine  
25 cavity 15. As the cartridge 5 is inserted, the ink ribbon 13 exposed between the supply spool 34 and the take up spool 32 slides in between the drive roller 30 and lowered print head 8.

Once the cartridge 5 is properly inserted into the  
30 print frame assembly 40, the cartridge 5 is locked into

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place by the lever operated cam assembly 74 that simultaneously urges the print head 8 into close proximity with the ribbon 13 and labeling media 22. It must be understood that the print head 8 is sufficiently urged into close proximity with the ribbon 13 and labeling media 22 to advance the ribbon 13 and media 22 simultaneously without slippage between the two. By simultaneously locking the cartridge 5 into place and raising the print head 8, the cartridge 5 is prevented from being removed from the print frame assembly 40 when the head 8 is closed.

Finally, referring to Fig. 6, drive spindles, 42 and 43, of a bidirectional stepping motor gear mechanism 70 mounted in the print frame assembly 40 rotatably drive the appropriate spool of the cartridge 5 to take up and supply the ink ribbon 13 past the print head 8. The stepping motor gear mechanism 70 also rotatably drives the drive roller 30 that advances the ribbon and labeling media past the print head 8. The print frame assembly 40 is mounted within the printing machine housing 2. A stepping motor gear mechanism 70 as used with this invention is fully described in copending patent application METHOD AND APPARATUS FOR MAINTAINING RIBBON TENSION, Attorney Docket No. 180003.93678 filed simultaneously with the present patent application and has been incorporated by reference herein.

Although spindles inserted into the spools through holes in the casings are herein described, other means to rotatably drive the spools may be employed. For

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example, teeth formed in one of the flanges may be engageably driven by a printing machine gear mechanism.

5 While there has been shown and described what are at present considered the preferred embodiment of the invention, it will be obvious to those skilled in the art that various changes and modifications can be made therein without departing from the scope of the invention defined by the appended claims.



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## CLAIMS

We claim:

1. An ink ribbon cartridge for a bidirectional hand held printer comprising:

a housing;

5 a supply spool having a roll of ink ribbon mounted thereon, said supply spool rotatably accommodated in said housing;

a take up spool rotatably accommodated in the said housing for receiving said ink ribbon from said supply spool;

10 a retaining means in said housing for positioning an end of each of said spools;

a tensioning member for maintaining tension on said ink ribbon.

2. An ink ribbon cartridge as in claim 1, wherein said tensioning member provides directional drag on each of said spools.

3. An ink ribbon cartridge as in claim 1, wherein said tensioning member is a pair of spring clips acting on each of said spools.

4. An ink ribbon cartridge of claim 1, wherein said housing forms an integral part of a printer exterior sidewall.

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5. An ink ribbon cartridge of claim 1, wherein said retaining means includes a leaf spring which engages the end of each spool and inhibits movement of the spools along their respective longitudinal axes.

6. An ink ribbon cartridge of claim 1, wherein said retaining means includes a pair of shafts inserted into the ends of the respective spools.

7. An ink ribbon cartridge for a bidirectional hand held printer comprising:

a base;

5 a pair of substantially cylindrical, parallel casings extending from said base, wherein said casings define a gap therebetween, said casings having slots;

a first spool having a roll of ink ribbon mounted thereon, said first spool rotatably accommodated in one of said casings;

10 a second spool rotatably accommodated in the other of said casings, wherein in one direction of travel of said ribbon, said ribbon unwinds from said first spool exits said casing through said casing slot, passes through said gap, and then enters said other casing  
15 through said other casing slot, and winds on to said second spool.

8. An ink ribbon cartridge as in claim 7 further comprising a retaining means in said base for positioning an end of each of said spools.

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9. An ink ribbon cartridge as in claim 7 further comprising a tensioning member for maintaining tension on said ink ribbon.

10. An ink ribbon cartridge as in claim 9, wherein said tensioning member provides directional drag on each of said spools.

11. An ink ribbon cartridge as in claim 9, wherein said tensioning member is a pair of spring clips acting on each of said spools.

12. An ink ribbon cartridge of claim 7, wherein said base forms an integral part of a printer exterior sidewall.

13. An ink ribbon cartridge of claim 7, wherein each of said spools is longitudinally retained in said cartridge by a leaf spring.

14. An ink ribbon cartridge of claim 7, wherein said base has a pair of shafts which are inserted into an end of said respective spools.

15. An ink ribbon cartridge of claim 7, wherein said casings have holes at an end opposite said base for insertion of drive spindles.

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FIG. 1

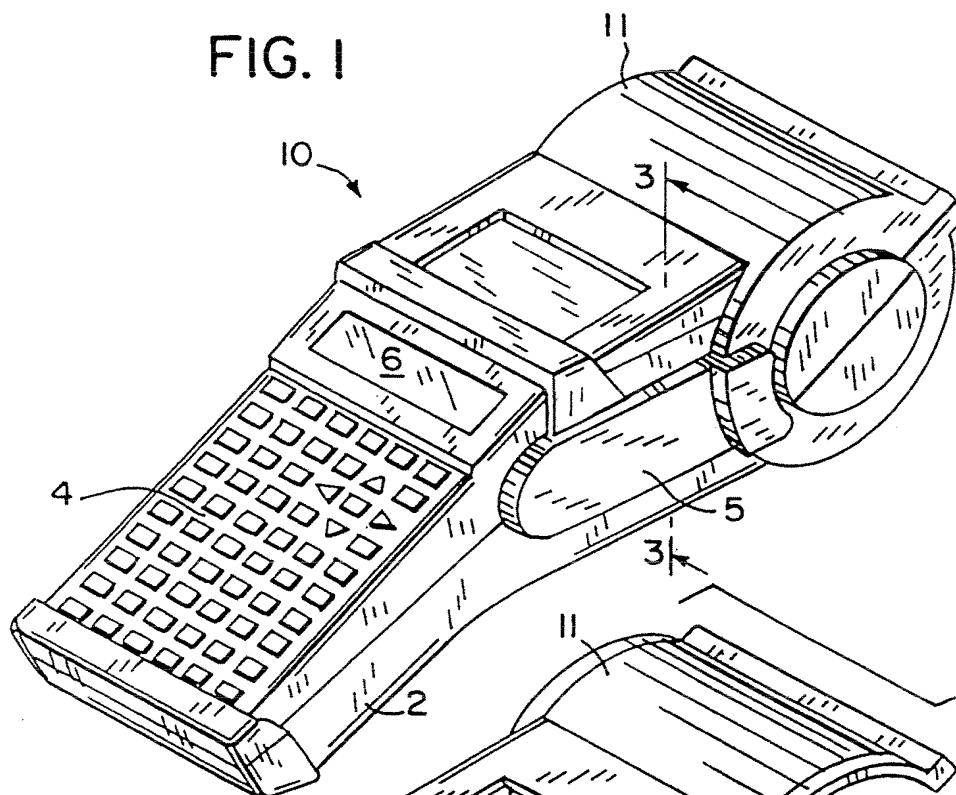
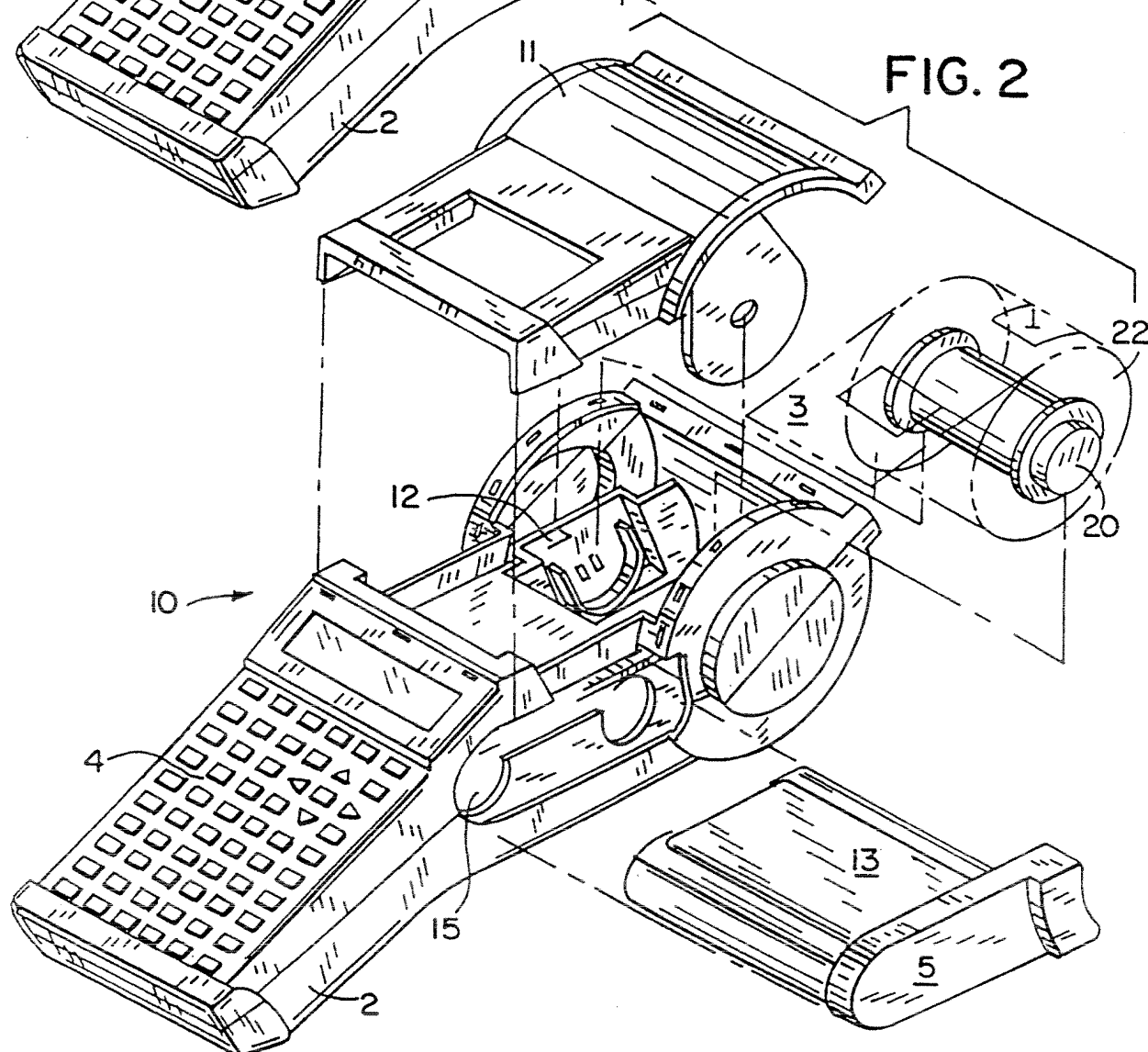


FIG. 2



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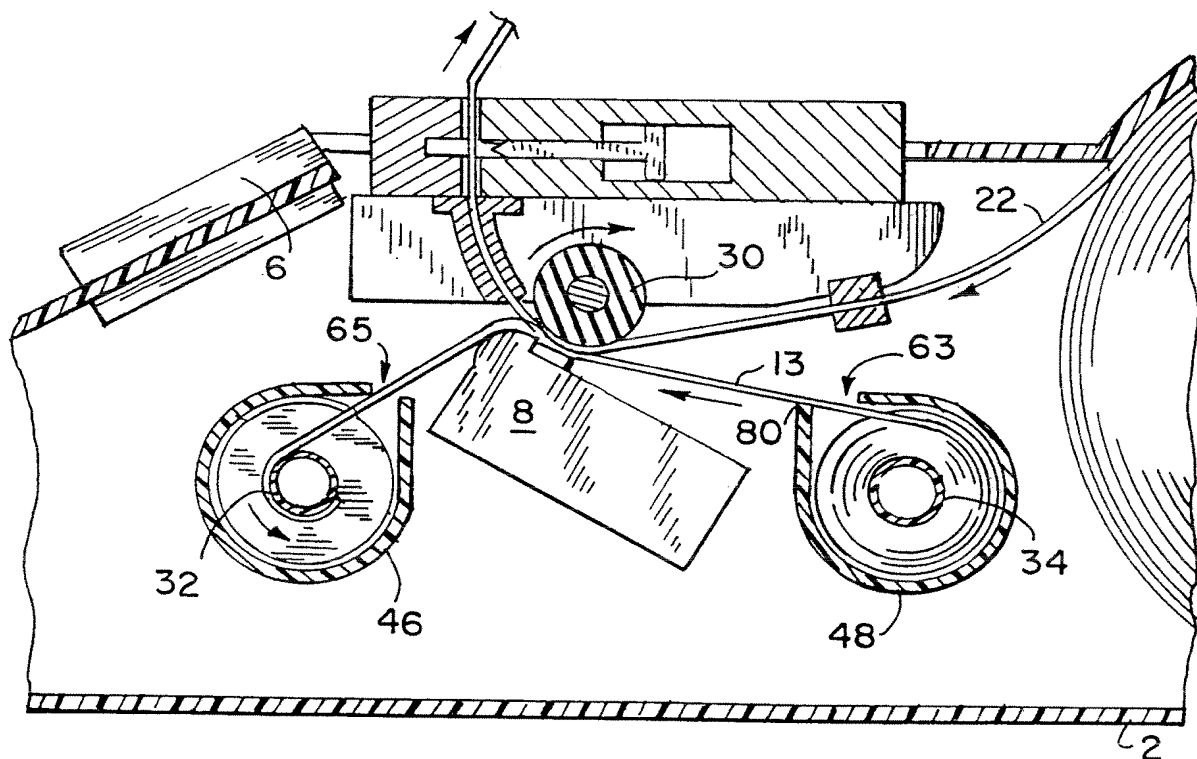
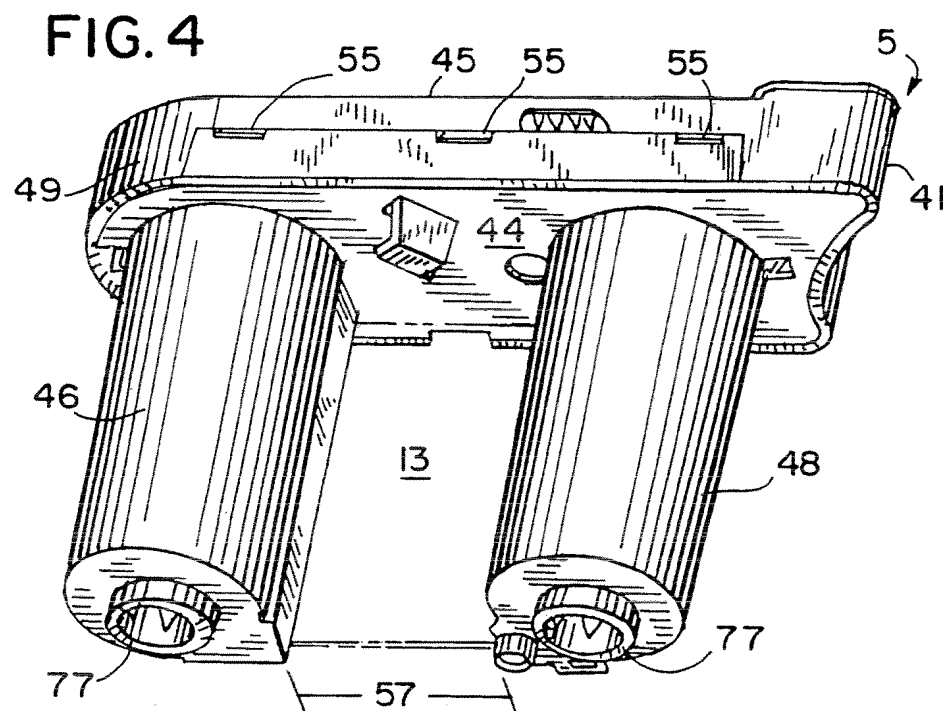
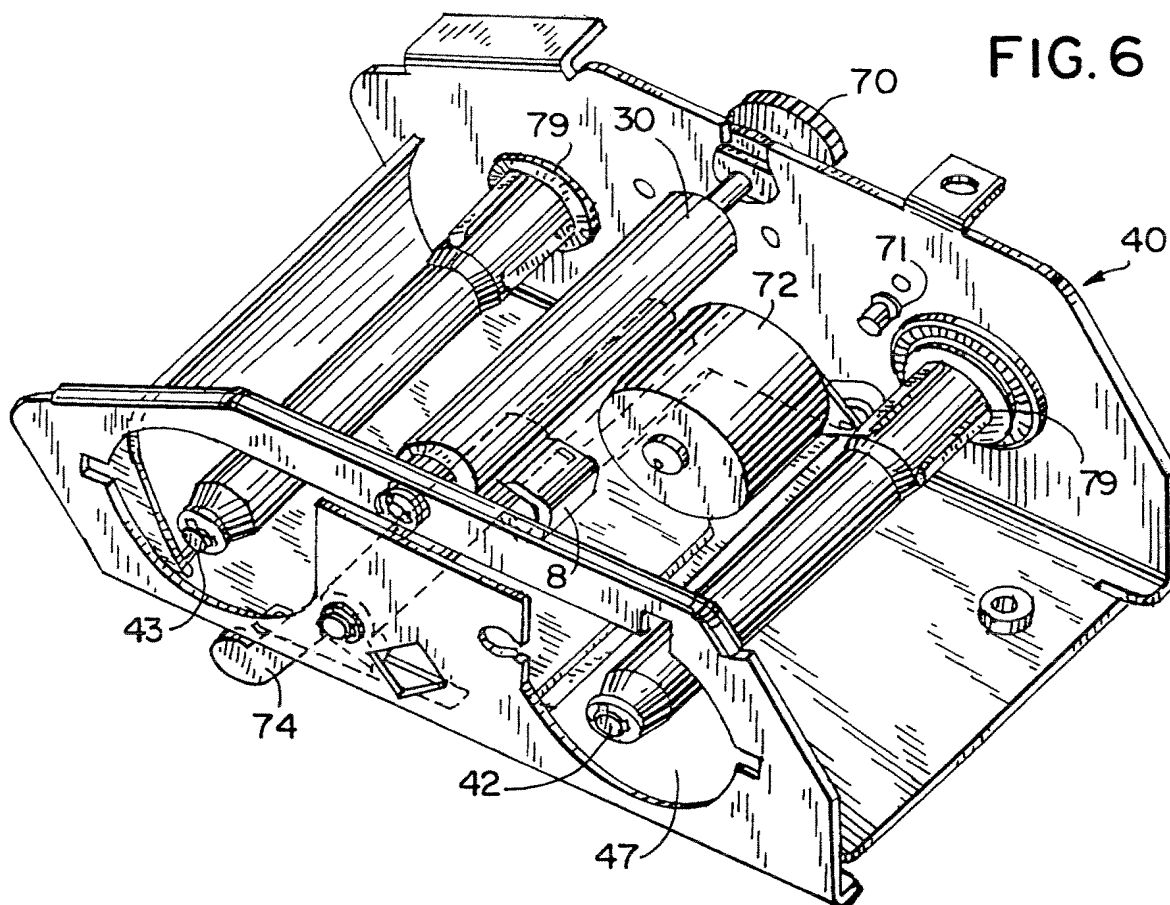


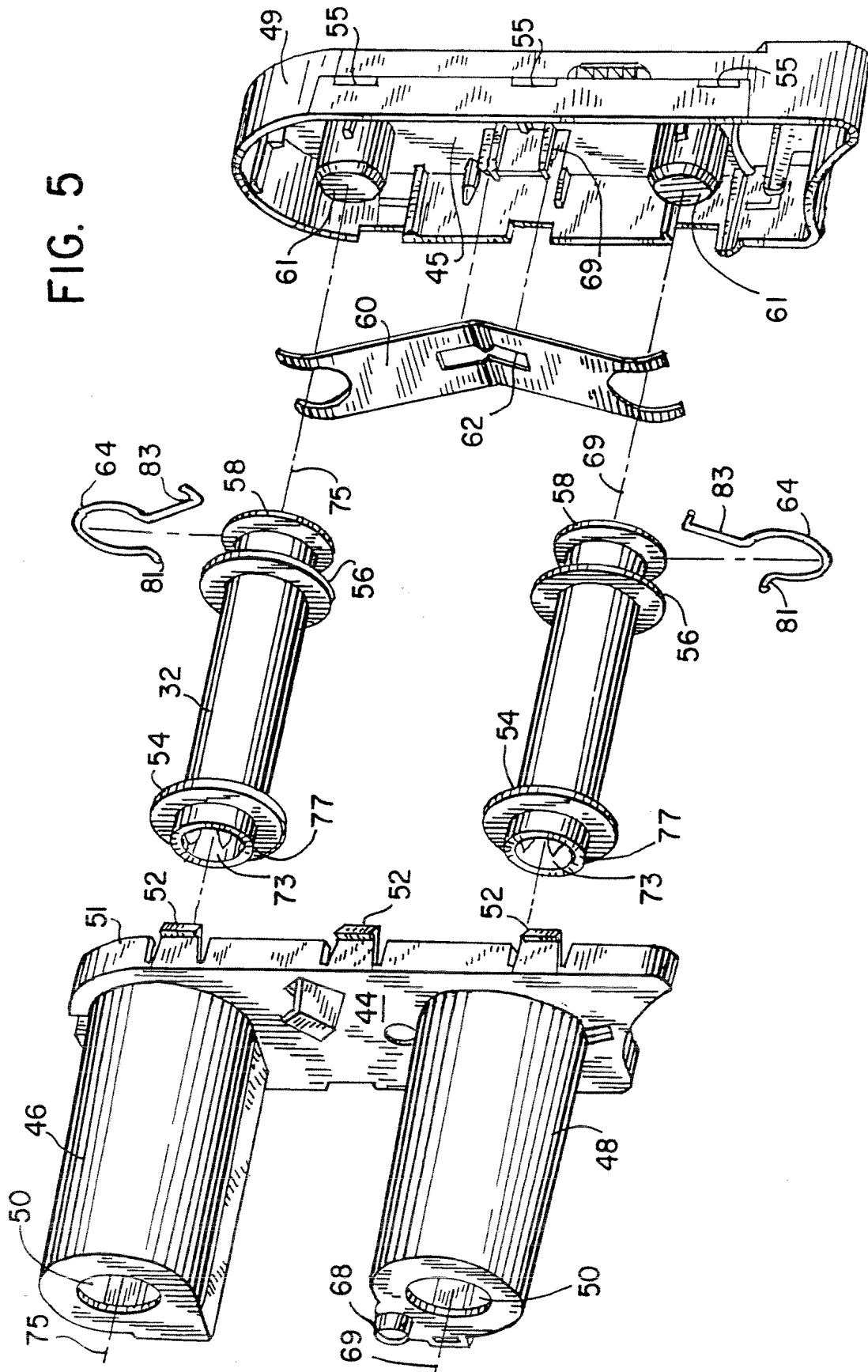
FIG. 3

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FIG. 5



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FIG. 7

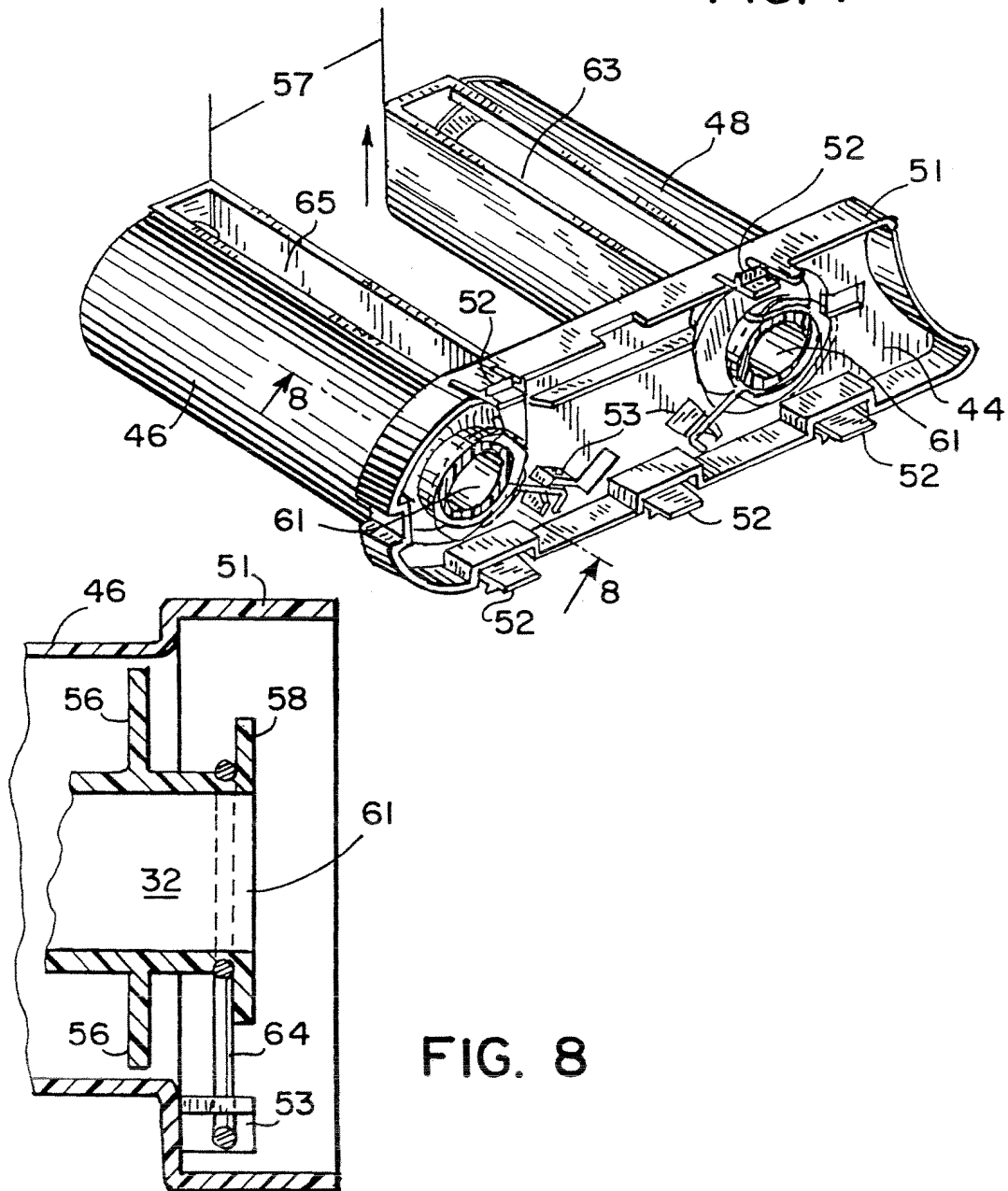


FIG. 8



# INTERNATIONAL SEARCH REPORT

Intern: al Application No

PCT/US 99/02843

## A. CLASSIFICATION OF SUBJECT MATTER

IPC 6 B41J17/32 B41J35/28 B65C11/02

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 6 B41J B65C

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 4 040 346 A (ORLENS ET AL.) 9 August 1977	1,2,5, 7-10,13, 15
A	see column 2, line 38 - line 63  see column 7, line 50 - column 8, line 63; figures 7-9	3,4,6, 11,12,14
Y	US 4 702 631 A (WATANABE) 27 October 1987	1,2,5, 7-10,13, 15
A	see column 5, line 39 - column 10, line 30; figures 4-14	3,4,6, 11,12,14
A	US 4 990 008 A (HWAN) 5 February 1991 see column 2, line 52 - column 5, line 52; figures 1-15	1-3,7-11
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Further documents are listed in the continuation of box C.



Patent family members are listed in annex.

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Date of the actual completion of the international search

3 June 1999

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## C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	EP 0 638 434 A (SONY CORPORATION) 15 February 1995 see column 3, line 43 - column 8, line 51; figures 1-37 ----	1,7
A	US 5 052 832 A (AKIYAMA ET AL.) 1 October 1991 see column 10, line 13 - column 14, line 30; figures 9-19 ----	1,7
A	PATENT ABSTRACTS OF JAPAN vol. 14, no. 42 (M-925), 25 January 1990 & JP 01 272477 A (OLYMPUS OPTICAL CO LTD), 31 October 1989 see abstract ----	1,7
A	PATENT ABSTRACTS OF JAPAN vol. 17, no. 552 (M-1491), 5 October 1993 & JP 05 155122 A (SONY CORP), 22 June 1993 see abstract -----	1,7

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Information on patent family members

International Application No

PCT/US 99/02843

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